

**APPENDIX C**

**EMISSION RATE CALCULATIONS FOR  
HEATING, VENTILATION, AND AIR CONDITIONING SYSTEMS  
AND BRINE REDUCTION AREA**

**(13 Pages)**

**TABLE C-1**

**TOOELE CHEMICAL AGENT DEMILITARIZATION FACILITY**  
**BRINE REDUCTION AREA EMISSION RATES**

**(Eight Pages)**

Table C-1  
TOCDF BRA Data

ANALYTE	MAXIMUM										MODIFIER	iRAP-h	
	RUN #1 (g/sec)	BL <sup>(1)</sup>	RUN #2 (g/sec)	BL <sup>(1)</sup>	RUN #3 (g/sec)	BL <sup>(1)</sup>	Mean (g/sec)	RATE (g/s)	Standard (g/s)	95% UCL (g/s)	Final Emission Rate (g/s)		EMISSION RATE <sup>(3)</sup> (g/s)
<b>Volatile Organic Compounds</b>													
Acetone	0.0E+00	S	0.0E+00	S	0.0E+00	S	0.0E+00	0.0E+00	0.0E+00	0.0E+00	S	2.8	0.0E+00
Benzene	0.0E+00	S	0.0E+00	S	0.0E+00	S	0.0E+00	0.0E+00	0.0E+00	0.0E+00	S	2.8	0.0E+00
Bromodichloromethane	0.0E+00	S	0.0E+00	S	0.0E+00	S	0.0E+00	0.0E+00	0.0E+00	0.0E+00	S	2.8	0.0E+00
Bromoform	0.0E+00	S	0.0E+00	S	0.0E+00	S	0.0E+00	0.0E+00	0.0E+00	0.0E+00	S	2.8	0.0E+00
Bromomethane (Methyl Bromide)	0.0E+00	S	0.0E+00	S	0.0E+00	S	0.0E+00	0.0E+00	0.0E+00	0.0E+00	S	2.8	0.0E+00
2-Butanone (MEK)	0.0E+00	S	0.0E+00	S	0.0E+00	S	0.0E+00	0.0E+00	0.0E+00	0.0E+00	S	2.8	0.0E+00
Carbon Disulfide	0.0E+00	S	0.0E+00	S	0.0E+00	S	0.0E+00	0.0E+00	0.0E+00	0.0E+00	S	2.8	0.0E+00
Carbon Tetrachloride	0.0E+00	S	0.0E+00	S	0.0E+00	S	0.0E+00	0.0E+00	0.0E+00	0.0E+00	S	2.8	0.0E+00
Chlorobenzene	0.0E+00	S	0.0E+00	S	0.0E+00	S	0.0E+00	0.0E+00	0.0E+00	0.0E+00	S	2.8	0.0E+00
Chlorodibromoethane	0.0E+00	S	0.0E+00	S	0.0E+00	S	0.0E+00	0.0E+00	0.0E+00	0.0E+00	S	2.8	0.0E+00
Chloroethane (Ethyl Chloride)	0.0E+00	S	0.0E+00	S	0.0E+00	S	0.0E+00	0.0E+00	0.0E+00	0.0E+00	S	2.8	0.0E+00
Chloroform	0.0E+00	S	0.0E+00	S	0.0E+00	S	0.0E+00	0.0E+00	0.0E+00	0.0E+00	S	2.8	0.0E+00
Chloromethane (Methyl Chloride)	0.0E+00	S	0.0E+00	S	0.0E+00	S	0.0E+00	0.0E+00	0.0E+00	0.0E+00	S	2.8	0.0E+00
Dibromomethane	0.0E+00	S	0.0E+00	S	0.0E+00	S	0.0E+00	0.0E+00	0.0E+00	0.0E+00	S	2.8	0.0E+00
Dichlorodifluoromethane (Freon 12)	0.0E+00	S	0.0E+00	S	0.0E+00	S	0.0E+00	0.0E+00	0.0E+00	0.0E+00	S	2.8	0.0E+00
1,1-Dichloroethane	0.0E+00	S	0.0E+00	S	0.0E+00	S	0.0E+00	0.0E+00	0.0E+00	0.0E+00	S	2.8	0.0E+00
1,1,2-Dichloroethane (EDC)	0.0E+00	S	0.0E+00	S	0.0E+00	S	0.0E+00	0.0E+00	0.0E+00	0.0E+00	S	2.8	0.0E+00
1,1,2-Dichloroethylene	0.0E+00	S	0.0E+00	S	0.0E+00	S	0.0E+00	0.0E+00	0.0E+00	0.0E+00	S	2.8	0.0E+00
trans-1,2-Dichloroethylene	0.0E+00	S	0.0E+00	S	0.0E+00	S	0.0E+00	0.0E+00	0.0E+00	0.0E+00	S	2.8	0.0E+00
1,2-Dichloropropane	0.0E+00	S	0.0E+00	S	0.0E+00	S	0.0E+00	0.0E+00	0.0E+00	0.0E+00	S	2.8	0.0E+00
cis-1,3-Dichloropropene	0.0E+00	S	0.0E+00	S	0.0E+00	S	0.0E+00	0.0E+00	0.0E+00	0.0E+00	S	2.8	0.0E+00
trans-1,3-Dichloropropene	0.0E+00	S	0.0E+00	S	0.0E+00	S	0.0E+00	0.0E+00	0.0E+00	0.0E+00	S	2.8	0.0E+00
Ethylbenzene	0.0E+00	S	0.0E+00	S	0.0E+00	S	0.0E+00	0.0E+00	0.0E+00	0.0E+00	S	2.8	0.0E+00
Iodomethane	0.0E+00	S	0.0E+00	S	0.0E+00	S	0.0E+00	0.0E+00	0.0E+00	0.0E+00	S	2.8	0.0E+00
Methylene Chloride	0.0E+00	S	0.0E+00	S	0.0E+00	S	0.0E+00	0.0E+00	0.0E+00	0.0E+00	S	2.8	0.0E+00
Styrene	0.0E+00	S	0.0E+00	S	0.0E+00	S	0.0E+00	0.0E+00	0.0E+00	0.0E+00	S	2.8	0.0E+00
1,1,2,2-Tetrachloroethane	0.0E+00	S	0.0E+00	S	0.0E+00	S	0.0E+00	0.0E+00	0.0E+00	0.0E+00	S	2.8	0.0E+00
Tetrachloroethene (PCE)	0.0E+00	S	0.0E+00	S	0.0E+00	S	0.0E+00	0.0E+00	0.0E+00	0.0E+00	S	2.8	0.0E+00
Toluene	0.0E+00	S	0.0E+00	S	0.0E+00	S	0.0E+00	0.0E+00	0.0E+00	0.0E+00	S	2.8	0.0E+00
1,1,1-Trichloroethane (TCA)	0.0E+00	S	0.0E+00	S	0.0E+00	S	0.0E+00	0.0E+00	0.0E+00	0.0E+00	S	2.8	0.0E+00
1,1,2-Trichloroethane	0.0E+00	S	0.0E+00	S	0.0E+00	S	0.0E+00	0.0E+00	0.0E+00	0.0E+00	S	2.8	0.0E+00
Trichloroethene (TCE)	0.0E+00	S	0.0E+00	S	0.0E+00	S	0.0E+00	0.0E+00	0.0E+00	0.0E+00	S	2.8	0.0E+00
1,2,3-Trichloropropane	0.0E+00	S	0.0E+00	S	0.0E+00	S	0.0E+00	0.0E+00	0.0E+00	0.0E+00	S	2.8	0.0E+00
Trichlorofluoromethane	0.0E+00	S	0.0E+00	S	0.0E+00	S	0.0E+00	0.0E+00	0.0E+00	0.0E+00	S	2.8	0.0E+00
Vinyl Chloride	0.0E+00	S	0.0E+00	S	0.0E+00	S	0.0E+00	0.0E+00	0.0E+00	0.0E+00	S	2.8	0.0E+00
m,p-Xylene	0.0E+00	S	0.0E+00	S	0.0E+00	S	0.0E+00	0.0E+00	0.0E+00	0.0E+00	S	2.8	0.0E+00
o-Xylene	0.0E+00	S	0.0E+00	S	0.0E+00	S	0.0E+00	0.0E+00	0.0E+00	0.0E+00	S	2.8	0.0E+00
Total Xylenes	0.0E+00	S	0.0E+00	S	0.0E+00	S	0.0E+00	0.0E+00	0.0E+00	0.0E+00	S	2.8	0.0E+00
<b>VOC Subtotals</b>							<b>0.0E+00</b>	<b>0.0E+00</b>		<b>0.0E+00</b>		<b>0.0E+00</b>	



**Table C-1**  
**TOCDF BRA Data**

Pentachlorophenol	0.0E+00	S	0.0E+00	S	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	S	2.8	0.0E+00
Phenacetin	0.0E+00	S	0.0E+00	S	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	S	2.8	0.0E+00
Phenanthrene	0.0E+00	S	0.0E+00	S	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	S	2.8	0.0E+00
Phenol	0.0E+00	S	0.0E+00	S	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	S	2.8	0.0E+00
2-Picoline	0.0E+00	S	0.0E+00	S	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	S	2.8	0.0E+00
Pronamide	0.0E+00	S	0.0E+00	S	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	S	2.8	0.0E+00
Pyrene	0.0E+00	S	0.0E+00	S	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	S	2.8	0.0E+00
1,2,4,5-Tetrachlorobenzene	0.0E+00	S	0.0E+00	S	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	S	2.8	0.0E+00
2,3,4,6-Tetrachlorophenol	0.0E+00	S	0.0E+00	S	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	S	2.8	0.0E+00
1,2,4-Trichlorobenzene	0.0E+00	S	0.0E+00	S	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	S	2.8	0.0E+00
2,4,5-Trichlorophenol	0.0E+00	S	0.0E+00	S	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	S	2.8	0.0E+00
2,4,6-Trichlorophenol	0.0E+00	S	0.0E+00	S	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	S	2.8	0.0E+00
2,4,6-Trinitrotoluene	0.0E+00	S	0.0E+00	S	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	S	2.8	0.0E+00
<b>SVOC Subtotals</b>						<b>0.0E+00</b>	<b>0.0E+00</b>					<b>0.0E+00</b>







Table C-1  
TOCDF BRA Data

ANALYTE METALS	MAXIMUM TOCDF EMISSION										MODIFIER FOR UPSET CONDITIONS <sup>(2)</sup>	iRAP-h EMISSION RATE <sup>(3)</sup> (g/s)	
	RUN #1 (g/sec)	BL <sup>(1)</sup>	RUN #2 (g/sec)	BL <sup>(1)</sup>	RUN #3 (g/sec)	BL <sup>(1)</sup>	Mean (g/sec)	RATE (g/s)	Standard (g/s)	95% UCL (g/s)	Final Emission Rate (g/s)		
Aluminum	1.0E-03	Y	8.9E-04	Y	7.9E-04	Y	8.9E-04	1.0E-03	1.1E-04	1.1E-03	1.0E-03	Y	1.45
Antimony	8.8E-06	N	9.6E-06	N	8.5E-06	N	9.0E-06	9.6E-06	5.7E-07	9.9E-06	9.6E-06	N	1.45
Arsenic	8.2E-06	N	8.3E-06	N	7.9E-06	N	8.1E-06	8.3E-06	2.1E-07	8.5E-06	8.3E-06	N	1.45
Barium	9.1E-06	Y	3.8E-06	Y	9.0E-06	Y	7.3E-06	9.1E-06	3.0E-06	1.2E-05	9.1E-06	Y	1.45
Boron	4.1E-06	N	4.2E-06	N	4.0E-06	N	4.1E-06	4.2E-06	1.0E-07	4.3E-06	4.2E-06	N	1.45
Beryllium	1.5E-04	Y	2.4E-04	Y	1.3E-04	Y	1.7E-04	2.4E-04	5.9E-05	2.7E-04	2.4E-04	Y	1.45
Cadmium	5.9E-06	Y	5.6E-06	Y	4.2E-06	Y	5.2E-06	5.9E-06	9.1E-07	6.8E-06	5.9E-06	Y	1.45
Chromium	1.8E-05	Y	1.7E-05	Y	6.9E-06	Y	1.4E-05	1.8E-05	6.1E-06	2.4E-05	1.8E-05	Y	1.45
Hexavalent Chromium	1.8E-05	Y	1.7E-05	Y	6.9E-06	Y	1.4E-05	1.8E-05	6.1E-06	2.4E-05	1.8E-05	Y	1.45
Cobalt	4.1E-06	N	4.2E-06	N	4.0E-06	N	4.1E-06	4.2E-06	1.0E-07	4.3E-06	4.2E-06	N	1.45
Copper	5.9E-06	Y	3.9E-06	Y	1.3E-06	Y	3.7E-06	5.9E-06	2.3E-06	7.6E-06	5.9E-06	Y	1.45
Lead	1.4E-04	Y	1.2E-04	Y	5.0E-05	Y	1.0E-04	1.4E-04	4.7E-05	1.8E-04	1.4E-04	Y	1.45
Manganese	8.1E-05	Y	8.3E-05	Y	1.5E-04	Y	1.0E-04	1.5E-04	3.9E-05	1.7E-04	1.5E-04	Y	1.45
Mercury	2.5E-02	N	1.1E-05	N	2.1E-05	N	8.3E-03	2.5E-02	1.4E-02	3.3E-02	2.5E-02	N	1.45
Nickel	8.1E-06	Y	8.9E-06	Y	1.7E-05	Y	6.5E-06	8.9E-06	3.4E-06	1.2E-05	8.9E-06	Y	1.45
Phosphorus	4.5E-02	Y	2.6E-02	Y	1.6E-02	Y	2.9E-02	4.5E-02	1.5E-02	5.4E-02	4.5E-02	Y	1.45
Selenium	8.1E-06	N	8.3E-06	N	7.9E-06	N	8.1E-06	8.3E-06	2.0E-07	8.4E-06	8.3E-06	N	1.45
Silver	2.1E-06	Y	2.1E-06	N	2.0E-06	N	2.1E-06	2.1E-06	5.8E-08	2.2E-06	2.1E-06	Y	1.45
Thallium	4.1E-06	N	4.2E-06	N	4.0E-06	N	4.1E-06	4.2E-06	1.0E-07	4.3E-06	4.2E-06	N	1.45
Tin	9.8E-05	N	1.0E-04	N	9.5E-05	N	9.8E-05	1.0E-04	2.5E-06	1.0E-04	1.0E-04	N	1.45
Vanadium	2.1E-05	N	2.1E-05	N	2.0E-05	N	2.1E-05	2.1E-05	5.8E-07	2.2E-05	2.1E-05	N	1.45
Zinc	2.8E-04	Y	3.0E-04	Y	2.2E-04	Y	2.7E-04	3.0E-04	4.2E-05	3.4E-04	3.0E-04	Y	1.45
<b>Metals Subtotals</b>							<b>3.9E-02</b>	<b>7.2E-02</b>		<b>7.2E-02</b>		<b>1.0E-01</b>	

**TOE Analysis** g/s

Subtotal TIC	0.00E+00
Subtotal Dioxin and Furans	0.00E+00
Subtotal PCB	0.00E+00
Subtotal VOC	0.00E+00
Subtotal Semivolatiles	0.00E+00
Subtotal Agent	0.00E+00
Total Identified Compounds	0.00E+00
<b>TOTAL = TOVoc+TOsvoc+TOGRAV</b>	<b>0.00E+00</b>
TOE Modifier	<b>1.00E+00</b>
	(No TO Data)

Notes:

BL	Boolean	HxCDF	Heptachlorobenzofuran	SVOC	Semivolatile organic compounds
CDD	chlorodibenzop(p)dioxin	HxCDD	Hexachlorobenzop(p)dioxin	TCDOD	Tetrachlorobenzop(p)dioxin
CDF	chlorodibenzofuran	HxCDF	Hexachlorodibenzofuran	TCDF	Tetrachlorodibenzofuran
FOB:	Fuel only burn	IRAP-h	Industrial Risk Assessment Program-Health	TIC	Tentatively identified compounds
g/sec:	Grams per second	MAX	Maximum	TO	Total organics
GB	ethyl N,N-dimethyl phosphoroamidocyanide	OCDD	Ostachlorobenzop(p)dioxin	TOE	Total organic emission
HCl	Hydrogen chloride	OCDF	Ostachlorodibenzofuran	UCL	Upper confidence level
HF	Hydrogen fluoride	PeCDD	Pentachlorobenzop(p)dioxin	VOC	Volatile organic compounds
HxCDD	Heptachlorobenzop(p)dioxin	PeCDF	Pentachlorodibenzofuran		

1 In the Boolean column, the "N" citation denotes that the analyte was not detected in any component of the referenced sample train.  
The "Y" citation denotes that the analyte was detected in one or more components of the referenced sample train.

The "S" citation indicates that the analyte was not included in the analysis for this agent trial burn or test burn.

The "X" citation indicates that no booleans were present in the spreadsheet data presented to Tetra Tech.  
Upset factors were based on the *TOCDF Incinerator Upset Conditions Estimate for 1998 Process Data Acquisition and Recording System Review* (EG&G 1999b). The emission rate multipliers are based on the percent of time each incinerator operates at non-peak performance (upset conditions). EG&G analyzed TOCDF facility operating records and data for the MPF, DFS, LIC1, and LIC2. These factors are derived by assuming that COPC emission rates during process upsets are 10 times greater than COPC emission rates measured during the trial burn test. Since a unit does not operate under upset conditions continually, the factor must be adjusted to account for only the period of time, on an annual basis, that a unit operates under upset conditions. Please refer to the protocol document for a more detailed discussion of upset factors.

2 maximum emission rate and the upset

3 Congener group summed by Tetra Tech.

4 Congener group sum is an analytical result reported in the trial burn test or test burn.

**TABLE C-2**

**TOOELE CHEMICAL AGENT DEMILITARIZATION FACILITY  
HEATING, VENTILATION, AND AIR CONDITIONING SYSTEM EMISSION RATES**

**(One Page)**

**Table C-2**  
**TOCDF HVAC Data**

TOCDF FILTER STACK - 1RUN-87

Stack flow rate

12.3 Stack gas velocity (m/s)  
2.2 Stack diameter  
47 dscm/min

CONSTITUENT NAME	EMISSION RATE (mg/m <sup>3</sup> )	EMISSION RATE (g/s)
Agent-GB	3.00E-04	2.34E-07
Agent-VX	3.00E-04	2.34E-07
Agent-HD	3.00E-02	2.34E-05

**TABLE C-3**

**CHEMICAL AGENT MUNITIONS DESTRUCTION FACILITY  
HEATING, VENTILATION, AND AIR CONDITIONING SYSTEM EMISSION RATES**

**(One Page)**

**Table C-3**  
**CAMDS HVAC Data**

CAMDS FILTER STACK - 1RUN-87

Stack flow rate

30.8 Stack gas velocity (m/s)  
0.56 Stack diameter (m)  
7.6 dscm/min

CONSTITUENT NAME	EMISSION RATE (mg/m3)	EMISSION RATE (g/s)
Agent-GB	3.00E-04	3.79E-08
Agent-VX	3.00E-04	3.79E-08
Agent-HD	3.00E-02	3.79E-08